

National Digital Mammography Archive

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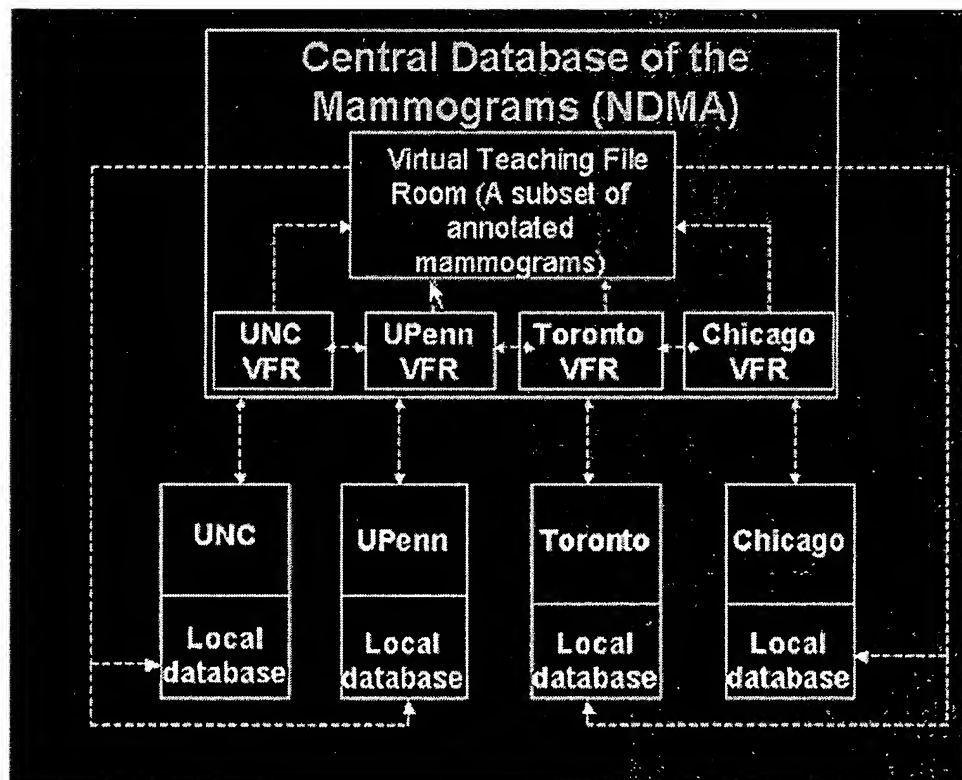
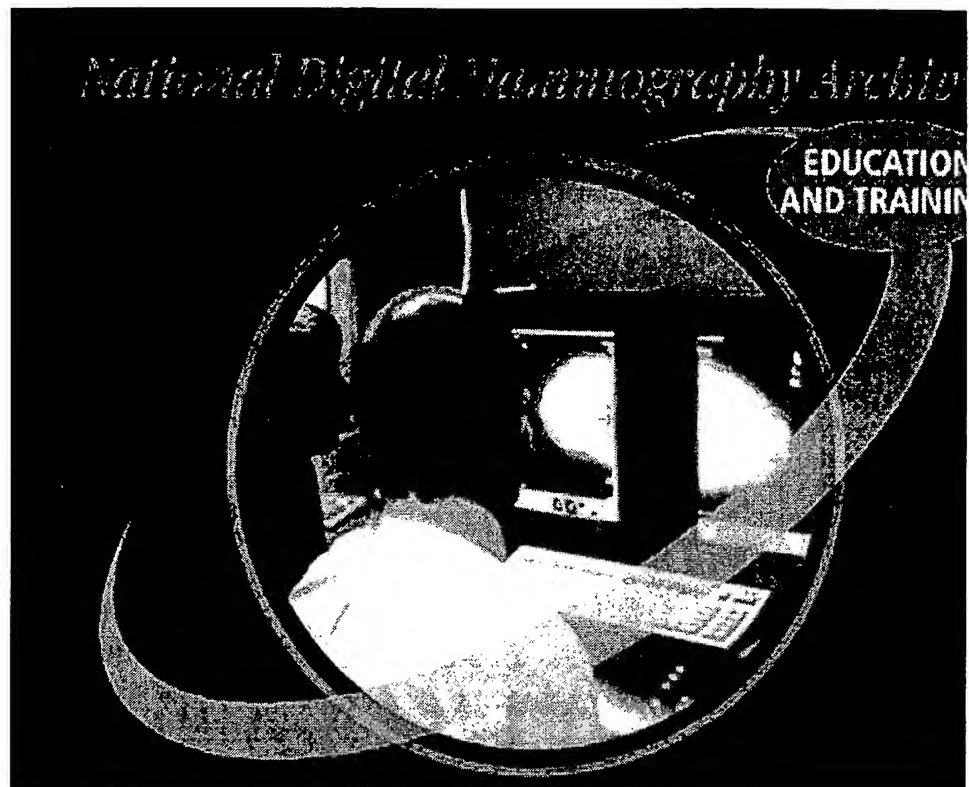
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Education

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Rationale for Tele-Education

Currently, teaching cases for the training of radiologists and mammographers are developed on an as-needed basis and generally created and maintained locally. This process necessarily limits exposure to interesting cases to the population served by a medical center or area. Some areas are not as demographically diverse to account for differences between ethnic groups, population ages or other factors. If radiologists have a way to annotate their digital mammogram images with specific location data based on pathology reports and other data, upload them to the ndma, and access them later, they could create an annotated case file for teaching, testing, and advanced training and make these images available to other sites. They could call on the richness of the data in the archive for interesting cases not otherwise readily available in their area.



Virtual Teaching File

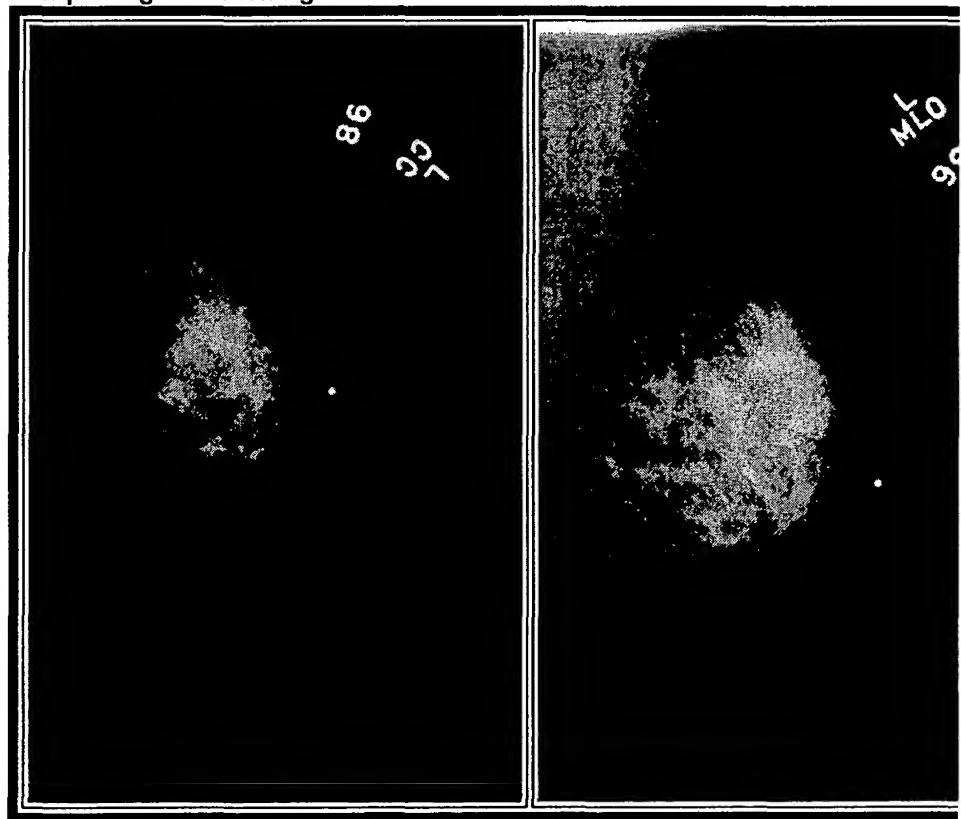
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Benefits

The large number of cases and rapid network access of the national archive will allow queries to rapidly generate images with specific findings for comparison to an examination being interpreted. The national image archive will generate a national teaching file, providing all training programs with equal access to critical teaching material. In addition, stratified clusters of cases could be generated in an automated fashion for testing progress of trainees.

- Web-based tool to annotate images and create annotated case file for archive
- Query archive for annotated cases based on BiRads lexicon
- Create teaching cases for residents and radiologists wanting to improve their skills
- Provide immediate feedback on teaching cases with links to annotations and pathology data
- Provide scores for testing without immediate feedback
- Permit large numbers of annotated cases to be brought down to local sites for training and testing purposes
- Make cases available to other sites

Sample Digital Teaching Case



The case provided is a calcifications case. Path proven Ductile Carcinoma in Situ (DCIS). Lesion located at the 12 o'clock position central left breast.

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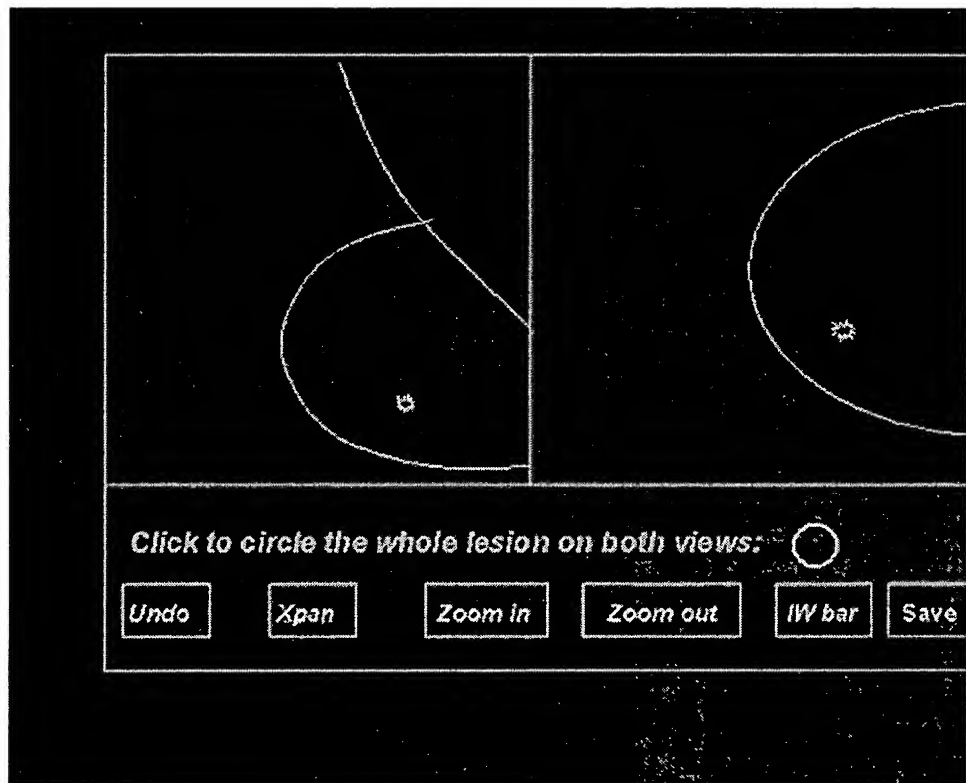
Components

There are three components associated with this application:

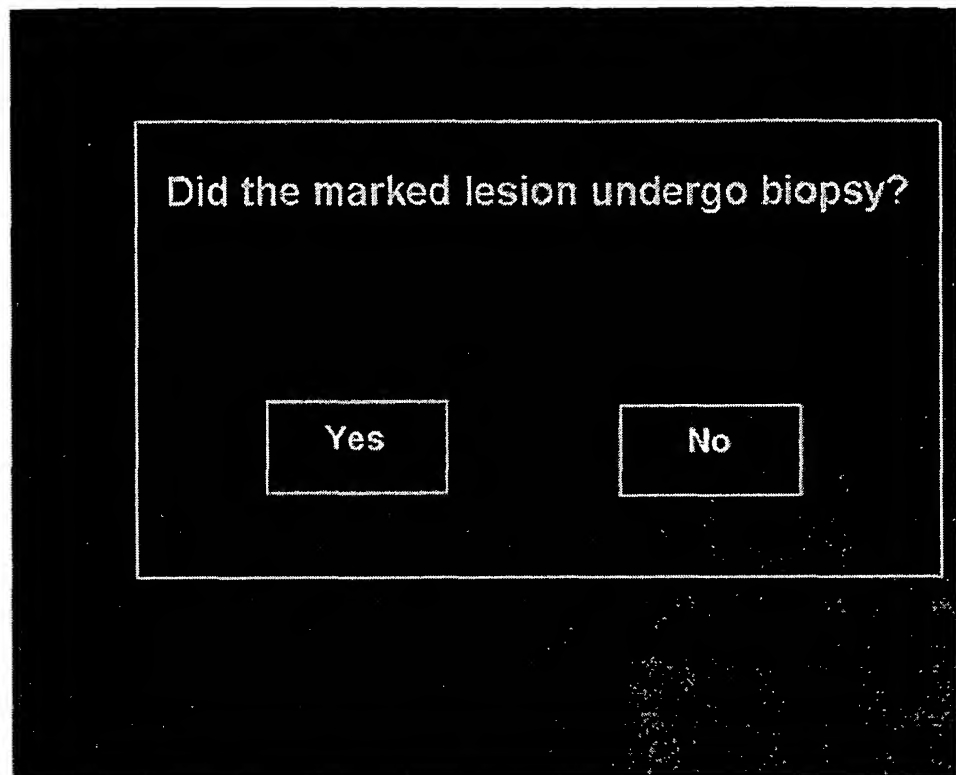
- Annotation and entry of cases into a Virtual Teaching File (Annotation Tool)
- Training Tool
- Testing Tool

Annotation Tool

- At local sites
- Web-based
- Smart Card protected



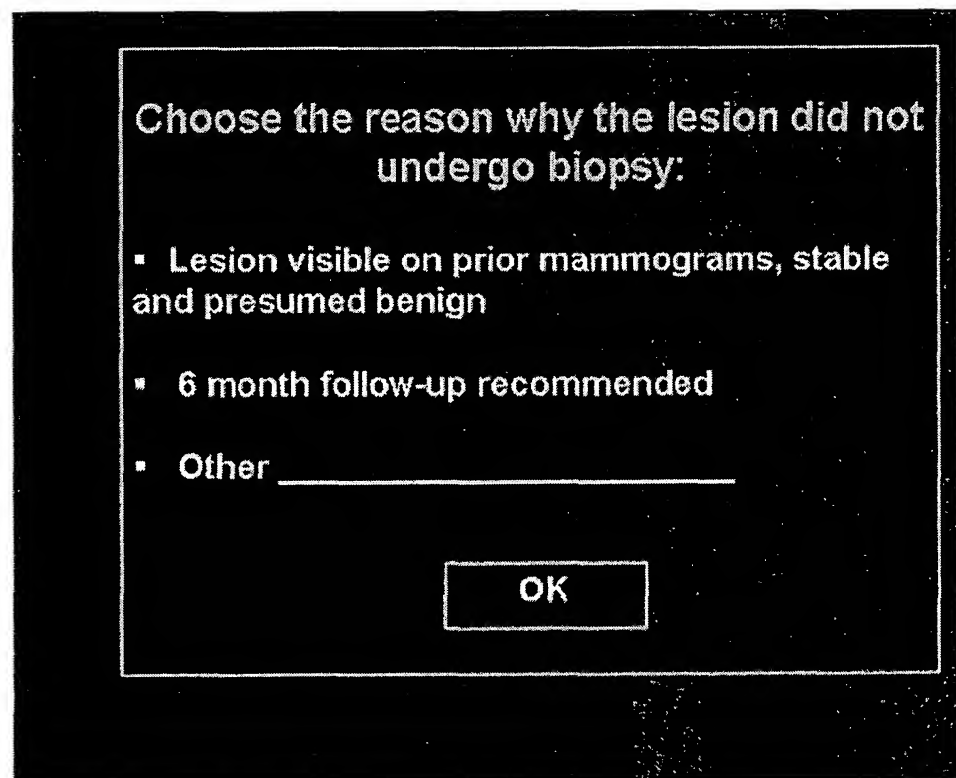
Sample Annotation Screen



Did the marked lesion undergo biopsy?

Yes No

Sample Annotation Content



Choose the reason why the lesion did not undergo biopsy:

- Lesion visible on prior mammograms, stable and presumed benign
- 6 month follow-up recommended
- Other _____

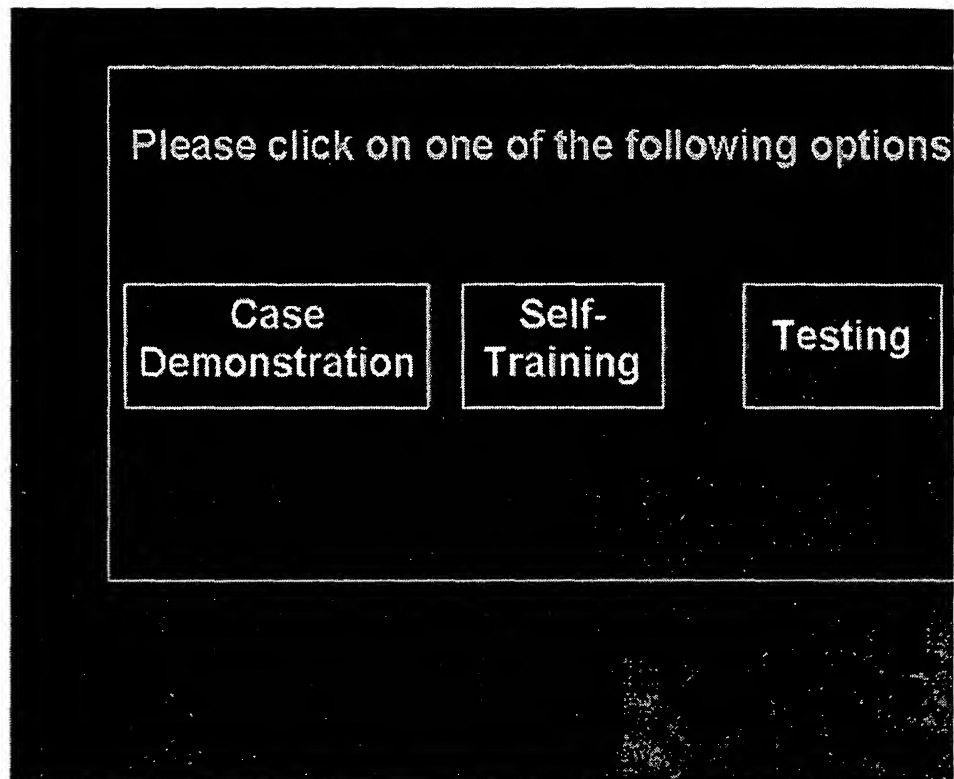
OK

Annotation Comments

Training Tool

- Will utilize GE workstation

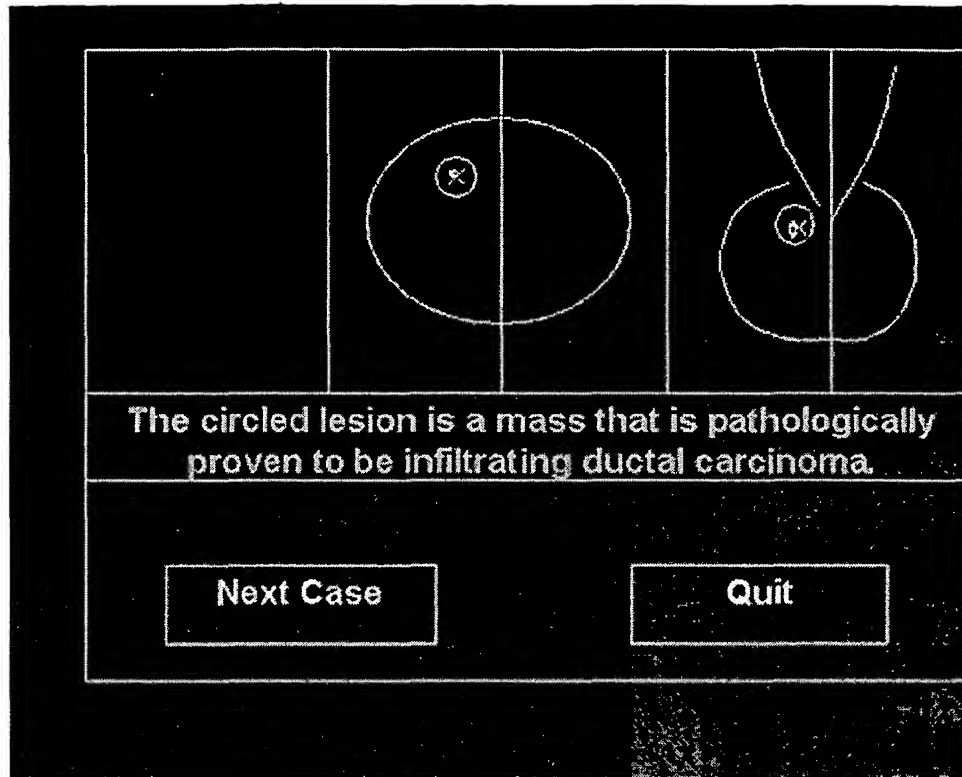
- Smart Card protected
- Two modes:
 - Case demonstration by teacher
 - Computer-generated case sets



Three Options for Teaching/Testing

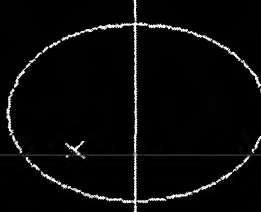
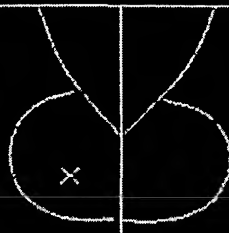

Case Demonstration Mode of Training Tool

- Teacher selects pathologic diagnosis, or lesion type, or both
- Three cases provided with request

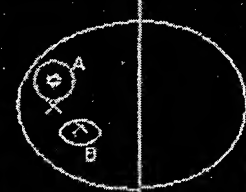
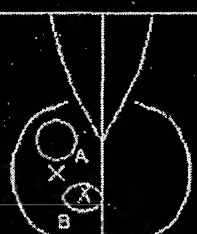
Case Demonstration Mode**Sample Case Demonstration Screen****Self-Training Mode of Training Tool**

- Smart Card Protected
- Keeps records of the performance of individual's over time
- Provides case sets for resident/fellow to review (30-50 cases per set) with immediate feedback
- Can be downloaded in advance of need (scheduled per resident/fellow cycle)

Self-Training Mode

Tools Click to point the center of the lesion: X Undo Xpan IW bar Submit						
Probability of malignancy (click on the probability): 						
Definitely Not Cancer	Almost Definitely Not Cancer	Probably Not Cancer	Possibly Cancer	Probably Cancer	Almost Definitely Cancer	Definitely Cancer
Are there more lesions in this case? <div style="display: flex; justify-content: space-around;"> Yes No </div>						

Sample Training Screen

Tools Click to point the center of the lesion: Undo Xpan IW bar Submit		
<p>Lesion A: Sorry, you missed the lesion that went to biopsy. (Or: Yes, you found the lesion that led to biopsy.) Lesion A is a mass that is pathologically-proven infiltrating ductal carcinoma.</p> <p>Lesion B: You marked the lesion correctly. Lesion B is a cluster of calcifications that is pathologically proven proliferative fibrocystic change.</p> <div style="text-align: center;"> OK </div>		

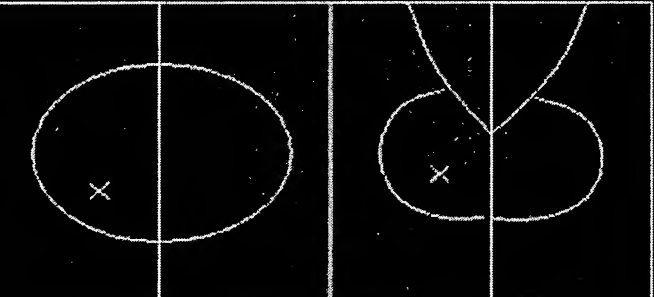
Trainee Receives Immediate Feedback

Testing Tool

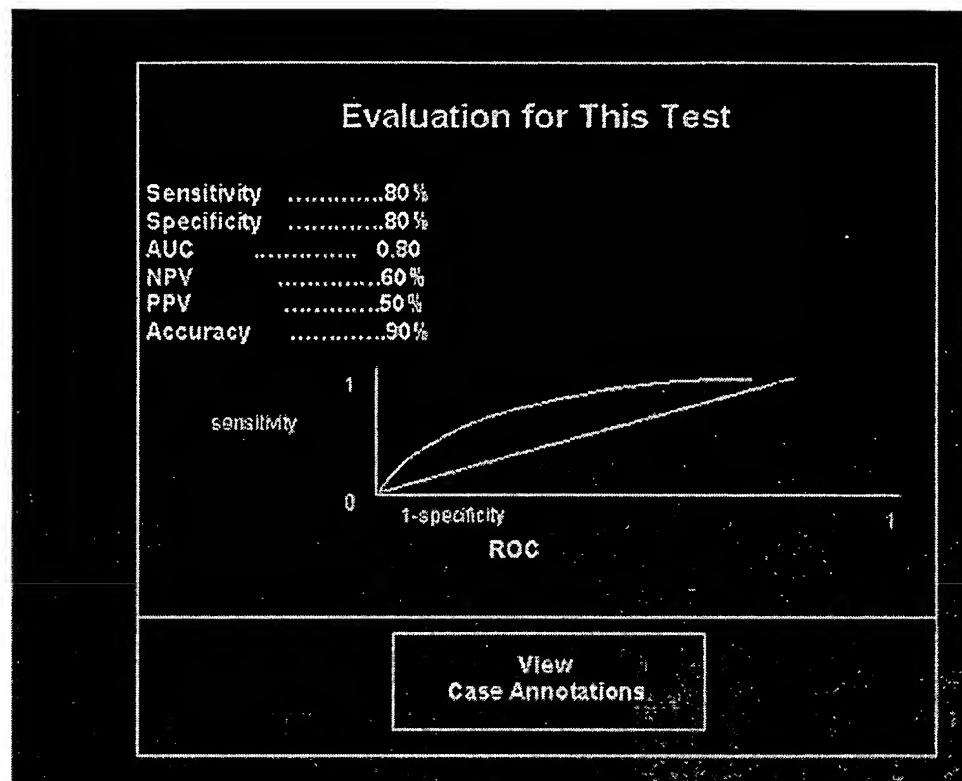
Testing Mode of Training Tool

- Smart Card Protected
- Keeps records of the performance of individual's over time
- Provides case sets for resident/fellow to undergo pre and post-test for rotation **WITHOUT** immediate feedback
- Can be downloaded in advance of need (scheduled per resident/fellow cycle)

Testing Mode

Tools Click to point the center of the lesion: <input type="checkbox"/> Undo Xpan IW bar Submit								
Probability of malignancy (click on the probability): <div style="text-align: center; margin-top: 10px;"> <div style="display: inline-block; width: 10%; border-bottom: 1px solid black; margin: 0 5px;"></div> <div style="display: inline-block; width: 10%; border-bottom: 1px solid black; margin: 0 5px;"></div> <div style="display: inline-block; width: 10%; border-bottom: 1px solid black; margin: 0 5px;"></div> <div style="display: inline-block; width: 10%; border-bottom: 1px solid black; margin: 0 5px;"></div> <div style="display: inline-block; width: 10%; border-bottom: 1px solid black; margin: 0 5px;"></div> <div style="display: inline-block; width: 10%; border-bottom: 1px solid black; margin: 0 5px;"></div> <div style="display: inline-block; width: 10%; border-bottom: 1px solid black; margin: 0 5px;"></div> </div>								
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 14.28%; padding: 5px;">Definitely Not Cancer</td> <td style="width: 14.28%; padding: 5px;">Almost Definitely Not Cancer</td> <td style="width: 14.28%; padding: 5px;">Probably Not Cancer</td> <td style="width: 14.28%; padding: 5px;">Possibly Cancer</td> <td style="width: 14.28%; padding: 5px;">Probably Cancer</td> <td style="width: 14.28%; padding: 5px;">Almost Definitely Cancer</td> <td style="width: 14.28%; padding: 5px;">Definitely Cancer</td> </tr> </table>		Definitely Not Cancer	Almost Definitely Not Cancer	Probably Not Cancer	Possibly Cancer	Probably Cancer	Almost Definitely Cancer	Definitely Cancer
Definitely Not Cancer	Almost Definitely Not Cancer	Probably Not Cancer	Possibly Cancer	Probably Cancer	Almost Definitely Cancer	Definitely Cancer		
Are there more lesions in this case? <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="border: 1px solid black; padding: 5px 20px;">Yes</div> <div style="border: 1px solid black; padding: 5px 20px;">No</div> </div>								

Sample Test Screen



Show Test Results

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The National Digital Mammography Archive (NDMA) is funded by the National Library of Medicine under the *Bio-Medical Applications for the Next Generation Internet* program. For questions or comments contact [Mitchell D. Schnall, M.D., Ph.D.](#), University of Pennsylvania.



UNITED STATES

National Library of Medicine